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EP 0357070 A EP 0114395 A WO 84/00616 A

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# (54) Holographic rear projection screen

(57) A holographic rear projection screen type light, includes a holographic sheet 8 having an incident surface for receiving projected light, a viewing surface having, a plurality of protrusions 4, for scattering the projected light, which are parallel to each other either vertically or horizontally, and a plurality of light absorbers 14 formed between the protrusions 4 for absorbing ambient light. There is preferably a Freshel lens sheet 6 between the projector and sheet 8. Thus, an image whose contrast is improved is displayed on a viewing surface.

FIG. 2A

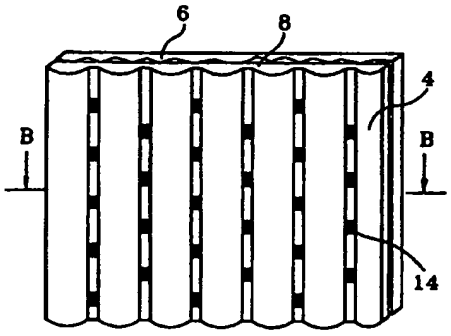


FIG. 2B

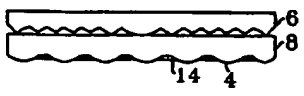


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FIG. 1 A
(PRIOR ART)

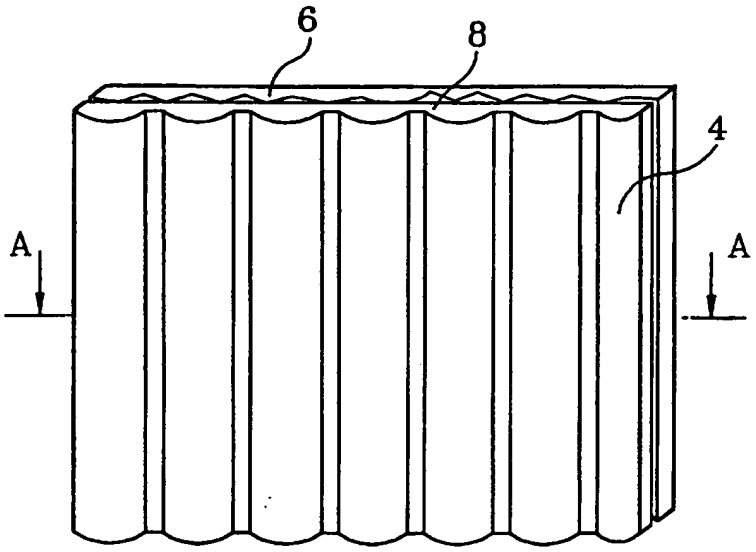



FIG. 1 B
(PRIOR ART)

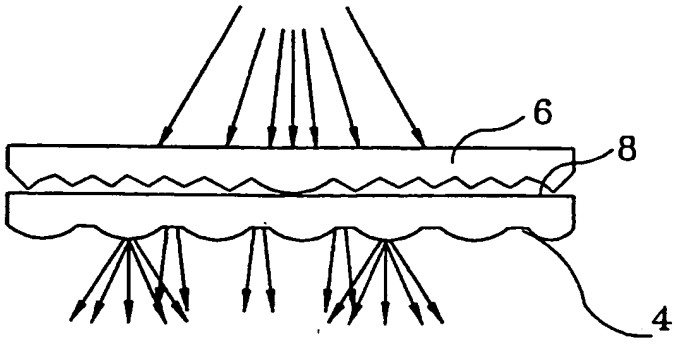


FIG. 2 A

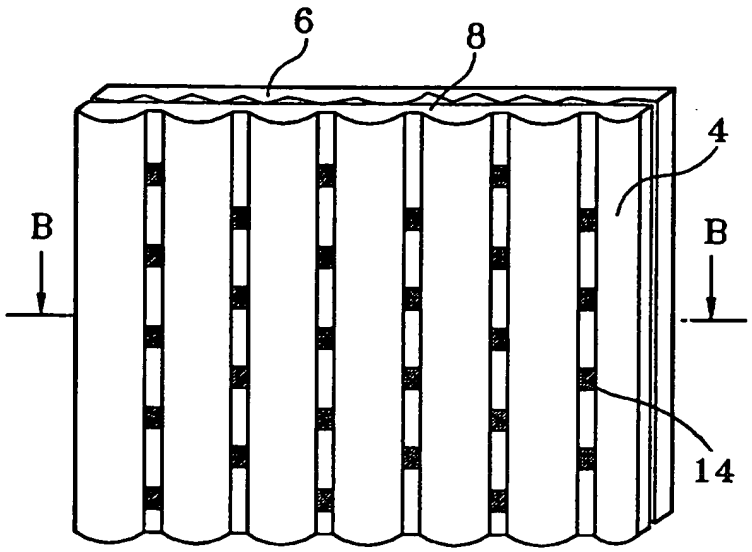
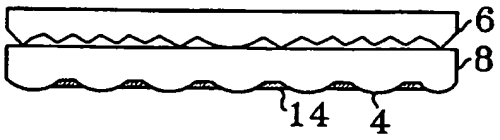



FIG. 2 B



# HOLOGRAPHIC SCREEN

The present invention relates to a rear projection screen for use in a projector, and more particularly, to a rear projection type holographic screen.

A general rear projection screen is made of a material containing a diffusion material. A rear projection screen including a lenticular lens and a Fresnel lens is most widely used. However, such a lenticular-Fresnel screen has a narrow angle of view and a limited luminance characteristic. Thus, a new screen for overcoming the above defects has been researched. As a result, a holographic screen has been proposed.

Since a holographic screen can be easily made once a master is manufactured and the features of the screen can be adjusted at will, it is currently used in most of the rear projection screen.

Figure 1A is a perspective view showing a conventional holographic screen which is used as a rear projection screen. Figure 1B is a sectional view cut along line A-A of the screen of Figure 1A. The holographic screen has a variety of shapes, which is chiefly comprised of a Fresnel lens sheet 6 and a holographic sheet 8. The holographic screen is made of a polymer of a transparent acryl-group such as acryl and polymethylmetacrylate (PMMA). The Fresnel lens sheet 6 is located closer to a projection light source than the holographic sheet 8, and has an uneven shape, which varies a focal point of projection light incident from a light source, on the surface far from the light source. Thus, the projection light transmitting the Fresnel lens sheet 6 has a substantially uniform light distribution

characteristic with respect to the surface of the screen. The projection light output from the Fresnel lens sheet 6 is incident to the holographic sheet 8. The holographic sheet 8 is formed on the viewing surface of the holographic screen, and has a diffusion plate function for forming an image by scattering the light incident from the Fresnel lens sheet 6. Protrusions 4 constituting the holographic sheet 8 are formed on the viewing surface of the screen and are disposed in parallel with the vertical axis of the holographic sheet 8. The protrusions 4 are disposed spaced from each other by a predetermined interval in the horizontal direction of the screen. Most of the light incident from the Fresnel lens sheet 6 transmits the protrusions 4. The projection light incident to the holographic sheet 8 is scattered by the protrusions 4 to become an image to be viewed.

However, an image formed on the holographic screen is not entirely apparent by ambient light. That is, the contrast of image is lowered.

With a view to solving or reducing the above problem, it is an aim of embodiments of the present invention to provide a holographic screen providing good image quality of images by improving contrast.

According to a first aspect of the present invention, there is provided a holographic screen of a rear projection type for use in a projector for projecting projection light incident from a rear end of the projector onto a viewing surface, the holographic screen comprising: a holographic sheet including an incident surface for receiving projection light, a viewing surface for forming the projection light incident to the incident surface into an image to be viewed, a plurality of protrusions for

scattering the incident projection light; and a plurality of light absorbers which are formed between said plurality of the protrusions on said viewing surface, for absorbing ambient light incident to said viewing surface.

Preferably, said protrusions are disposed in parallel with each other.

Preferably, said protrusions are disposed in a vertical direction. Alternatively, they may be disposed in a horizontal direction.

Said plurality of light absorbers formed between the adjacent protrusions may be of a shape of a mat.

Said plurality of light absorbers preferably substantially completely absorb ambient light incident to themselves.

Said plurality of light absorbers may occupy about 25% of the entire surface area possessed by said viewing surface.

Said plurality of light absorbers may be of a coated black material.

The holographic screen may further comprise a Fresnel lens sheet which converges the rear-projected light onto the incident surface of said holographic sheet.

For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:

Figure 1A is a perspective view showing a conventional holographic screen which is used as a rear projection screen;

Figure 1B is a sectional view cut along line A-A of the screen of Figure 1A;

Figure 2A is a perspective view of a holographic screen according to a preferred embodiment of the present invention; and

Figure 2B is a sectional view cut along a line B-B of the Figure 2A screen.

A preferred embodiment of the present invention will be described in detail with reference to the accompanying drawings.

In Figure 2A, the holographic screen includes a Fresnel lens sheet 6, a holographic sheet 8 and a plurality of protrusions 4. The plurality of the protrusions 4 are formed on a viewing screen of a screen as in Figure 1, and disposed in parallel with each other with respect to the vertical axis of the holographic sheet 8. The protrusions 4 are disposed spaced by a predetermined interval in the vertical direction of the screen.

The holographic sheet 8 comprises a plurality of light absorbers 14 each of which is formed between neighbouring two protrusions 4. The plurality of light absorbers 14 absorb ambient light incident to a viewing surface from the outside of the screen. When the light absorbers 14 are not used, the ambient light incident to the viewing surface is irregularly reflected on the

viewing surface. The contrast of an image formed on the viewing surface of the holographic sheet 8 is lowered.

That is, to prevent the lowering of the contrast of the image from the ambient light, the light absorbers 14 are used. The light absorbers 14 rarely transmit the light incident from the Fresnel lens sheet 6 onto the viewing surface. Therefore, although the light absorbers 14 occupy a portion of the viewing surface, light loss is not brought about by a surface area occupied by the light absorbers 14. Thus, the holographic screen of Figure 2A maintains a substantially similar gain with respect to the light projected from a light source (not shown).

Each light absorber 14 is formed by coating on the viewing surface of the holographic sheet 8 as shown in Figure 2B, and has a shape of a mat as shown in Figure 2A. It is desirable that the light absorbers 14 are made of a material having an optical characteristic for completely absorbing the ambient light incident to themselves. Therefore, the light absorbers 14 in the embodiment of the present invention are made of a black material having a high absorption with respect to the light. The light absorbers 14 occupy 25% of the entire surface area possessed by the viewing surface of the holographic screen. The surface area occupied by the light absorbers 14 on the viewing surface can be enlarged. However, as the surface area occupied by the light absorbers 14 becomes wider, the brightness of the image formed on the viewing surface can be lowered. Thus, it is preferable that the light absorbers 14 occupy about 25% of the entire surface area possessed by the viewing surface of the holographic screen.

The above embodiment has been described with respect to the protrusions 14 which are disposed in parallel with each other in the vertical direction and the light absorbers 14 disposed between the protrusions 14. However, it is apparent to one having an ordinary skill in the art that a modification could be made so that the protrusions 14 are disposed in parallel with each other in a different direction such as the horizontal direction and the light absorbers could be disposed between the protrusions 14 in the same manner as in the above embodiment.

The holographic screen of the above-described embodiment includes the Fresnel lens sheet 6 and the holographic sheet 8. However, since a holographic sheet 8 can be fabricated so that light projected from a light source advances to a particular direction, a holographic screen according to the principles of the present invention can be manufactured using a holographic sheet 8 only.

As described above, holographic screens according to embodiments of the present invention can be made including a plurality of light absorbers for absorbing ambient light between the protrusions, to bring about an effect for improving a contrast of an image formed on a viewing surface.

While only certain embodiments of the invention have been specifically described herein, it will be apparent that numerous modifications may be made thereto without departing from the scope of the invention.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to

this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

**CLAIMS**

1. A holographic screen of a rear projection type for use in a projector for projecting projection light incident from a rear end of the projector onto a viewing surface, the holographic screen comprising:

a holographic sheet including an incident surface for receiving projection light, a viewing surface for forming the projection light incident to the incident surface into an image to be viewed, a plurality of protrusions for scattering the incident projection light; and

a plurality of light absorbers which are formed between said plurality of the protrusions on said viewing surface, for absorbing ambient light incident to said viewing surface.

2. The holographic screen of claim 1, wherein said protrusions are disposed in parallel with each other.

3. The holographic screen of claim 1 or 2, wherein said protrusions are disposed in a vertical direction.

4. The holographic screen of claim 1 or 2, wherein said protrusions are disposed in a horizontal direction.

5. The holographic screen of a rear projection type according to claim 1, 2, 3 or 4, wherein said plurality of light absorbers formed between the adjacent protrusions are of a shape of a mat.

6. The holographic screen of a rear projection type according to any of the preceding claims, wherein said

plurality of light absorbers substantially completely absorb ambient light incident to themselves.

7. The holographic screen of a rear projection type according to any of the preceding claims, wherein said plurality of light absorbers occupy about 25% of the entire surface area possessed by said viewing surface.

8. The holographic screen of a rear projection type according to any of the preceding claims, wherein said plurality of light absorbers are coated black materials.

9. The holographic screen of a rear projection type according to any of the preceding claims, further comprising a Fresnel lens sheet which converges the rear-projected light onto the incident surface of said holographic sheet.

10. A holographic screen substantially as herein described, with reference to Figure 2A and 2B.

The Patent Office

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**Application No:** GB 9705893.7 **Examiner:** Meredith Reynolds
**Claims searched:** 1-10 **Date of search:** 11 June 1997

## Patents Act 1977
## Search Report under Section 17

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G2X(X42B), G2J(J33B1)

Int Cl (Ed.6): G02B,G03B

Other: Online:WPI

**Documents considered to be relevant:**

| Category | Identity of document and relevant passage | | Relevant to claims |
|---|---|---|---|
| A | EP 0357070A | (Hughes)(Figs 3-4,Claim 4) | |
| A | EP 0114395A | (Mitsubishi)(Figs 1-7) | |
| A | WO 84/00616A | (Hughes)(Figs 3 and 5) | |

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| X | Document indicating lack of novelty or inventive step | A | Document indicating technological background and/or state of the art. |
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